Math 229 Calculus Computer Lab Spring 15 Sample Midterm 1

- You may only use `julia` during this exam. No calculators or cell phones.

(1) Write a short `julia` command to generate each of the following sequences.

  (a) `julia` command to set `x` to be for the integers from 1 to 50.

  (b) Use `map` to assign `x` to be the first 50 square numbers, $[1, 4, 9, 16, \ldots, 2500]$.

(2) Convert the following `julia` expressions to standard mathematical expressions. Use parentheses to clearly indicate the order of operations:

  (a) `x-y/x+z`

  (b) `sin(x)^2/5*sqrt(x)`

  (c) `(x-y*(z+x))/(y-x)`

(3) Convert each of the following expressions to its `julia` equivalent:

  (a) x^{y^z}

  (b) $\dfrac{x}{1 + \frac{y}{z+1}}$

  (c) $\dfrac{\arctan^2 x}{8} + \dfrac{5e^{\sqrt{x}}}{3}$

  Explain how you would check each one was correct, and do so.

(4) Is `1/2x` the same as `1/2*x`? How would you check? Explain.

(5) You want to compute a decimal approximate to $1/\sqrt{7}$. Explain what the following `julia` commands compute, or why they give an error.

  (a) `1/7^1/2`

  (b) `1/(7^1/2)`

(c) `1/sqrt(7^(-1))`

Write down a `julia` command which produces a decimal approximate to $1/\sqrt{7}$. Explain how to check your result.

(6) Let $f(x) = 2x^4 - 13x^2 - 30$. Write the commands to compute the roots of $f(x)$ using both the `roots` and `fzeros` functions in `julia`. Explain why they give different answers.

(7) Plot the following functions on the interval $(\pi, 6)$.

$$f(x) = \frac{\sin(11x)}{e^x} \qquad\qquad g(x) = \frac{\cos(11x)}{e^x}$$

(a) Sketch the graphs.

(b) What is the number of local minima for each function? (Exclude end-points)

(c) What is the number of local maxima for each function? (Exclude end-points)

(8) Find the minimum (to two decimal places) of $f(x) = \left(\cos(x) + \dfrac{1}{(x-\pi)^2}\right)$ on $(0, \pi)$. Write down the `julia` commands you used to get your answer.

(9) Use `julia` to find where the following functions are equal (to two decimal places). Write down the `julia` commands, and/or explain how you got your answer.

$$f(x) = 5\cos(3x) \quad\text{and}\quad g(x) = -7x + 50$$

(10) Write down `julia` commands to define two functions $f(x) = \frac{1+x^2}{3}$ and $g(x) = \sin^2(\frac{1}{2x})$, and compute $f(g(1))$.

(11) Write down `julia` commands to define a function $f(x)$ which has value 1 for $-1 \le x \le 1$ and 0 for other values of x, and plot its graph to check you are correct.